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Final Report of the Air Traffic Evaluation of the Automated Surface Observing System (ASOS) Displays

William Benner
Chris Malitsky

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16. Abstract

The Automated Surface Observing System (ASOS) is a weather collection and display system that will be installed in airport traffic control towers (ATCTs) and other strategic areas designated by the National Weather Service (NWS). The ASOS system is being procured, installed, operated, and maintained by the National Oceanic and Atmospheric Administration (NOAA) for the Federal Aviation Administration (FAA) under a Memorandum of Agreement (MOA).

This report encompasses the results of the third evaluation of the limited production ASOS displays and the results of a followup ad hoc meeting after the evaluation was completed. The third ASOS evaluation was conducted at the Will Rogers World Airport, Ok; Wiley Post Airport, Ok; Tulsa International Airport, OK; Lincoln Municipal Airport, NE; Johnson County Airport, KS; Rosecrans Memorial Airport, MO; and Grand Island Airport, NE.

On-site air traffic control (ATC) personnel evaluated the ASOS hardware (keyboard and displays) in an operational environment and then completed questionnaires provided by the FAA Technical Center. The completed questionnaires were then analyzed by Technical Center personnel with the results presented at the ad hoc meeting. It was recommended that new modifications be made to the Controller Video Display (CVD) and Operator Interface Device (OID). These modifications were prioritized with a short- and long-term schedule.

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EXECUTIVE SUMMARY

The Automated Surface Observing System (ASOS) is a weather collection and display system that will be installed in airport traffic control towers (ATCT) and at locations designated by the National Weather Service (NWS). The system is being procured, installed, operated, and maintained by the National Oceanic and Atmospheric Administration (NOAA) for the Federal Aviation Administration (FAA) under a Memorandum of Agreement (MOA). The NWS is a service operating under NOAA. Weather observer personnel who work for the NWS, will eventually be phased out or augmented when ASOS is commissioned.

This report encompasses the results of the third evaluation of the ASOS and the results of a followup ad hoc meeting after the evaluation was completed. The third evaluation of the ASOS was accomplished at Will Rogers World Airport, OK; Wiley Post Airport, OK; Tulsa International Airport, OK; Lincoln Municipal Airport, NE; Johnson County Airport, KS; Rosecrans Memorial Airport, MO; and Grand Island Airport, NE. Data was collected via questionnaires completed by air traffic control specialists (ATCS) at the seven airport sites and analyzed by personnel assigned to the FAA Technical Center Weather and Primary Radar Division, ACW-200.

The evaluation responses indicated the ATCSs felt the ASOS, as it currently exists, does not help in performing weather observations and is not ready for operational use. The results of the evaluation led to agreed upon changes to the ASOS identified at the ad hoc meeting which will be prioritized by the FAA Weather Sensors Program Office, ANW-400, and forwarded to NOAA and the prime contractor for action.

INTRODUCTION

The Automated Surface Observing System (ASOS) is a computer-based system consisting of an array of sensors and communication ports. The ASOS is engineered to provide continuous automatic airport weather observations to tower air traffic controllers, via alphanumeric displays, and to pilots, via radio or phone. It will generate 1-minute observations, hourly Surface Aviation Observations (SAOs), and special and local observations. The ASOS will report wind speed and direction; pressure; temperature and dew point; visibility to 10 miles; selected obstructions to vision; precipitation identification, intensity and amount; freezing rain; and sky condition to 12,000 feet.

The intent of the ASOS program is to implement automated weather observing systems which employ today's technology as a means of improving the weather services provided to the National Airspace System (NAS). At towered airports, ASOS will improve on the weather services already provided by relieving National Weather Service (NWS) staff of the manual collection of weather data, and by providing standardized, and more objective observations while ultimately decreasing cost. At nontowered airports, ASOS will provide weather observation services that are currently not available.

The Federal Aviation Administration (FAA) has a planned requirement for at least 537 ASOSs of two different operational levels; (1) a nontowered or small airport level where there is currently no federal weather observing program, and (2) towered or larger airport level where there is an existing federal weather observing program.

PURPOSE.

This was the third evaluation of ASOS and was conducted at the request of Air Traffic Plans and Requirements Service (ATR), Washington Headquarters at the following airports:

1. Will Rogers World Airport, OK;
2. Wiley Post Airport, OK;
3. Tulsa International Airport, OK;
4. Lincoln Airport, NE;
5. Johnson County Airport, KS;
6. Rosecrans Memorial Airport, MO;
7. Grand Island Airport, NE.

The selection of these particular airports was based upon:

1. location (NWS area of most diverse weather patterns);
2. tower activity level;
3. multiregion area (Southwest Region, ASW, and Central Region, ACE).

Of the seven sites selected, four were commissioned ASOS sites and were required to use the ASOS data for official weather for that airport. The remaining three sites were either noncommissioned ASOS sites that continued to use NWS weather reporting or Limited Aviation Weather Reporting Station (LAWRS) sites that compiled the official weather themselves. Prepared scenarios were used by these three sites in order to manipulate the ASOS during the evaluation.

EVALUATION

EVALUATION ISSUES.

Controllers at the 7 airports (totaling 82 personnel) were requested to evaluate the ASOS in order to:

1. assess the ASOS in an operational environment;

2. prioritize eight* issues/requirements concerning the Operator Interface Device (OID) and Controller Video Display (CVD) that were identified in the two previous ASOS evaluations and to reveal any new issues;

3. determine impact on controller workload;

4. assess display readability;

5. assess equipment fit in the operational environment; and

6. assess content and format of the CVD display data.

EVALUATION CONDUCT.

The controller evaluators at each of the seven sites were briefed about the evaluation and then given the questionnaires at the conclusion of the evaluation. The questionnaire was designed using positive statements reflecting the issues/requirements previously mentioned. The controllers were given up to 60 days to evaluate the system. The evaluators had the choice of agreeing or disagreeing with the questionnaire statements; depending upon their evaluation of the system. If the evaluators disagreed with the statement, they were requested to elaborate on why they disagreed.

The evaluation questionnaire consisted of four parts: (1) ASOS Questionnaire for the Control Tower Cab which was administered to all seven sites; (2) TRACON Supplemental Questionnaire which was administered to those sites having a Terminal Radar Approach Control (TRACON); (3) LAWRS Supplemental Questionnaire which was administered to the two LAWRS facilities; and (4) Summary Questionnaire which was free-form and entirely voluntary. These questionnaires are contained in appendix A.

The equipment evaluated was the Operator Interface Device (OID), the Controller Video Display (CVD), the OID Keyboard, and the Operator Notification Device (OND).

(*Note - There are nine issues identified in the Air Traffic Operational Evaluation of the ASOS Displays plan. The ninth issue concerns the use of a telephone as part of the ASOS hardware for transmitting and monitoring ASOS data). The issue was not evaluated since the ASOS data was not being broadcast at any of the seven sites.

RESULTS OF EVALUATION.

The numerical results of the evaluations were compiled and are contained in appendices B and C.

DISCUSSION

AD HOC MEETING.

Following the evaluation, an ad hoc meeting was held January 12 through 15, 1993, at the FAA Technical Center. The ad hoc meeting was established to discuss the evaluation results. Members who attended represented the seven air traffic field facilities who took part in the ASOS evaluation, Air Traffic (AT) personnel from Washington Headquarters Weather Sensors Program Office, NWS, National Oceanic and Atmospheric Administration (NOAA), FAA Technical Center's Weather/Primary Radar Division, ACW-200, and support personnel. (See list of attendees in appendix D.)

The objectives of the ad hoc meeting were to:

1. discuss the results of the third ASOS evaluation;

2. Prioritize short- and long-term modifications to the ASOS that will be required in order to deploy the equipment to the remaining tower facilities;

3. develop a time schedule to incorporate the modifications.

AD HOC DISCUSSION.

The results of the evaluation responses were presented to the ad hoc group. The group debated the relative merit of keyboard and display devices. The OID and CVD were compared with generic Information Display Systems (IDS) and previously installed systems such as System Atlanta Information Display System (SA-IDS). According to AT headquarters personnel, there are already approximately 150 SA-IDS devices installed in various control towers and they would prefer having the weather data sent to an IDS type terminal rather than use the CVD.

There is a concern too many display monitors and keyboards exist in the control tower. Some towers have up to five different displays in the tower cab not including the ASOS OID and keyboard. ATC tower personnel would prefer to reduce the number of tower displays by combining several ATC functions into one IDS.

Discussions by the committee also included the need for a source of "real-time" wind direction and velocity. Controller representatives stated that a pilot needs to receive real-time winds, not averaged 5-second delay winds. The NOAA representative responded that if the FAA wants ASOS to provide real-time winds, then the FAA must submit this requirement to the NWS.

The short- and long-term objectives list was updated throughout the remainder of the meeting. The following items surfaced for discussion or were added to the requirements list:

1. Controller representatives asked that an alarm be generated when the weather observation is being transmitted. This was added to the requirements list.

2. Controller representatives expressed concern that too many special observations are being generated. This results in increased responsibility as well as increased workload for the controller. AT is working on resolving this problem.

3. Controller representatives felt that they should have access to weather observations from other airports. The NOAA representative responded that ASOS could be modified to provide this information if a new requirement was generated.

4. Controller representatives stated they have little confidence in the ASOS weather data compared to reporting means which were used previously. They prefer that the observation be displayed in the standard one-line format. It was pointed out that the CVD has a display limit of 240 characters. This led to a lengthy discussion on the relative merits of an IDS type display versus the CVD. Because of the limited space available on the CVD, the comments in the weather observation are not displayed at the controllers' positions in the TRACON (i.e., the CVD). Consequently, only the controllers in the tower see the weather observation comments on the OID.

5. Automatic Terminal Information Service (ATIS) will be interfaced with the ASOS as a part of the tower automation program.

6. The controllers have concern they will have to augment weather if the NWS weather observers are removed. This increases controller workload and responsibility. This makes the controllers role more of a data distributor which takes away from their primary role of controlling aircraft. The NOAA representative responded that many of the special observations that require augmentation are as a result of less than ideal sighting locations. Therefore, controllers may be required to override incorrect ASOS data. AT representatives stated they are working on this issue.

7. Another problem is when a controller wants to review data, he must log off the OID in order to get to the data review function. NOAA will take action to provide controllers the Review Data function as a new requirement.

8. Data from the evaluation was inconclusive, concerning the controllers' reaction to having Hot Key functions, in that the sample was extremely small; however, the controller representatives at the meeting were strongly in favor of Hot Keys. The FAA will take action to identify to NOAA which functions (thunderstorms, hail, tornadoes, verga, volcanic ash, etc.) they would like included as Hot Keys.

9. The ONDs were evaluated at two of the tower locations. They resemble a rotating flashing beacon and are envisioned for use in areas that have a noisy environment where audible alarms would be of little use. Controllers were not in favor of the use of ONDs.

The ad hoc team made the following conclusions:

1. Short- and long-term recommendations for improving the ASOS for AT use were developed during the ad hoc meeting. A short-term requirements schedule was developed and is contained in appendix E;

2. The FAA must determine if they want ASOS to provide real-time wind velocity data in lieu of what is currently displayed;

3. NOAA will provide feedback to FAA field personnel concerning trouble reports and corrective action taken;

4. ANW-400 will address the possibility of replacing the VT-320 OIDs with Intel 486 compatible computers in order to reduce interface problems;

5. ANW-400 and NOAA will address removal of the requirement of the controller to signoff in order to review data;

6. The FAA will address the issue of Hot Keys. ANW-400 will provide information on the number of Hot Keys, type of information, and which functions need to be provided to NOAA;

7. NWS to reemphasize the NWS requirement in Handbook No.7 that the weather observer make an observation that is representative of the airport conditions and issue a special observation when appropriate.

RECOMMENDATIONS

As a result of the evaluation and the ad hoc meeting, the following Controller Video Display (CVD) and Operator Interface Device (OID) modification recommendations will be made to the program office and to National Oceanic and Atmospheric Administration (NOAA):

SHORT TERM.

1. CVD

a. Information that should be displayed now.

(1) Complete Surface Aviation Observation (SAO) (standard displayed one-line format, 240 characters maximum).

(2) Five lines of free text static display.

(3) 1-minute altimeter update.

(4) Multiple page capability.

(5) Highlighted 2-minute winds, 5-second update (separately).

(6) Obstruction to visibility displayed with all visibility.

(7) VGA display with background color choice.

(8) 30-second message flashing "New Observation Transmitting."

2. OID

a. The following items must be provided as soon as possible:

(1) Five-line free text static display on 1-minute screen (350 characters minimum).

(2) Multiple page capability for air traffic control (ATC) users.

(3) Second alarm for SAO Transmitting (must have Automatic Terminal Information Services (ATIS) interface).

(4) Programmable time for alarms.

(5) No Auto Log-off.

(6) A second beep at the start of weather transmission (when SAO begins).

b. Other information that must be provided.

(1) Other facilities Automation Weather Observing System (AWOS)/ Automatic Surface Observing System (ASOS) weather observations.

LONG TERM.

1. CVD

a. Information that should be displayed.

(1) Low Level Wind Shear Alert System (LLWAS) winds vice ASOS where applicable.

2. OID

a. OID Functions

(1) Provide review capability.

APPENDIX A

QUESTIONNAIRES

AIR TRAFFIC OPERATIONAL SITE EVALUATION

OF THE

AUTOMATED SURFACE OBSERVING SYSTEM (ASOS)

EVALUATION QUESTIONNAIRE

TOWER_____ DATE_____

ATCS OPERATOR INITIALS _____

ASOS QUESTIONNAIRE FOR THE CONTROL TOWER CAB

OPERATOR INPUT DEVICE (OID) PHYSICAL CHARACTERISTICS

1. How would you complete the following statement? (check one)
" The size of the OID monitor is _____too large, _____too small, _____satisfactory."

2. If your answer to question 1 was **too large** or **too small**, what size monitor would you recommend? (i.e. 9", 11", 13", etc.)

_____

_____

3. How would you complete the following statement? (check one)
"The size of the keyboard is _____too large, _____too small, _____satisfactory."

4. If your answer to question 3 was **too large** or **too small**, what size keyboard do you recommend? (i.e. special design, laptop, etc.)

_____

_____

5. "The glare from sunlight/light on the OID has little or no effect on its readability".
_____agree _____disagree

If you disagree, please explain why.

_____

_____

6. "The swivel and tilt of the OID monitor provides all the adjustment necessary for good viewing angle and reduction of glare".
_____agree _____disagree

If you disagree, please explain why.

_____

_____

OID FUNCTIONS

DO YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENTS? (check one for each statement)

1. "There is no requirement or necessity for an ASOS password in FAA facilities."
   _____agree _____disagree

   If you disagree, please explain why.
   _____
   _____

2. "An ASOS alarm sounds the same as other alarms already in the control tower cab."
   _____agree _____disagree

   If you disagree, please explain why.
   _____
   _____

3. "The message displayed on the OID indicating that the alarm is disabled is a necessity."
   _____ agree _____disagree

   If you disagree, please explain why.
   _____
   _____

4. "The weather data is presented in an acceptable format for AT use."
   _____agree _____ disagree

   If you disagree, please explain why.
   _____
   _____

OID FUNCTIONS (continued)

5. "The steps required to input tower visibility are reasonable."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

6. "The steps required to view archived data are reasonable."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

7. "The steps required to recover from an input error are reasonable."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

8. "The steps required to save data for a mishap are reasonable."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

CONTROLLER VIDEO DISPLAY (CVD) PHYSICAL CHARACTERISTICS

How would you complete statements 1 thru 5? (check one)

1. "The window size of the CVD is _____."
   _____too large _____too small _____satisfactory

2. If your answer to question 1 was **too large** or **too small**, what size CVD window do you recommend? (i.e. 4" x 6", 3" x 5", etc.)
   _____
   _____

3. "The overall size (outside dimension) of the CVD is _____."
   _____too large _____too small _____satisfactory

4. "The glare from sunlight/light on the surface mount CVD _____."
   _____has little or no effect on its readability
   _____somewhat affects its readability
   _____affects its readability quite a bit
   _____completely inhibits its readability

NOTE: RESPOND TO QUESTIONS 5 AND 6 ONLY IF YOU HAVE A FLUSH MOUNT IN YOUR TOWER.

5. "The glare from sunlight/light on the flush mount CVD _____."
   _____has little or no effect on its readability
   _____somewhat affects its readability
   _____affects its readability quite a bit
   _____completely inhibits its readability

CVD PHYSICAL CHARACTERISTICS (continued)

DO YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENTS? (check one for each statement)

6. "The night readability of the CVD alphanumerics on a flush mount is satisfactory."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

7. "The night readability of the CVD alphanumerics on a surface mount is satisfactory."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

8. "The size of the alphanumerics on the CVD is satisfactory."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

9. "The adjustability of the surface mount CVD for viewing is satisfactory."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

CVD PHYSICAL CHARACTERISTICS (continued)

10. "The surface mount CVD easily stays in an adjusted position."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

11. "The CVD reset button is used quite frequently to re-display weather data."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

12. "The CVD reset button contrast and brightness controls are correctly located."
_____agree _____disagree

If you disagree, please describe where you would locate them.

_____

_____

CVD DISPLAY

DO YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENTS? (check one for each statement).

1. "The weather parameters as presented on the CVD, are in a satisfactory format."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

2. "The weather parameters as presented on the CVD, are all that are necessary to provide to the pilot."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

3. "The wind direction and velocity, and altimeter are all that are necessary to be highlighted on the CVD."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

4. "The CVD offers sufficient adjustability for brightness and contrast."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

5. "The background color of the display is appropriate for the tower cab."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

TELECOMMUNICATIONS:

DO YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENTS? (check one for each statement)

1. "The menu (number of steps) for voice input and record capability is reasonable."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

2. "The OID handset can withstand normal operational use in the tower."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

3. There is adequate visual indication that **"voice record"** is activated."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

TRACON SUPPLEMENT

CONTROLLER VIDEO DISPLAY (CVD) - TRACON:

DO YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENTS? (check one for each statement)

1. "The CVD is easily readable from the normal working positions in the TRACON."
   _____agree _____disagree

   If you disagree, please explain why.

   _____
   _____

2. "The background of the display is appropriate for the TRACON."
   _____agree _____disagree

   If you disagree, please explain why.

   _____
   _____

3. "The CVD offers sufficient adjustability for brightness and contrast."
   _____agree _____disagree

   If you disagree, please explain why.

   _____
   _____

4. "Highlighted messages are readable."
   _____agree _____disagree

   If you disagree, please explain why.

   _____
   _____

OBSERVER NOTIFICATION DEVICE (OND) (Olathe & St. Joseph)

DO YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENTS? (check on for each statement)

1. "The OND provides an excellent visual signal to gain the controller's attention."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

2. "The OND is not a distraction when lighted."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

3. "The brightness of the OND is satisfactory."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

4. "The OND is a necessary option."
   _____agree _____disagree

   If you disagree, please explain why.

   _____

   _____

LAWRS SUPPLEMENT

LAWRS-TOWER CAB SUPPLEMENTAL QUESTIONS-OID:

DO YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENTS? (check one for each statement)

1. "The steps required to enter remarks are reasonable."
   _____agree _____disagree

   If you disagree, please explain why.

   _____
   _____

2. "The steps required to edit the present weather are reasonable."
   _____agree _____disagree

   If you disagree, please explain why.

   _____
   _____

3. "The steps required to augment the present weather are reasonable."
   _____agree _____disagree

   If you disagree, please explain why.

   _____
   _____

4. "The steps required to generate an urgent special are reasonable."
   _____agree _____disagree

   If you disagree, please explain why.

   _____
   _____

LAWRS-TOWER CAB
SUPPLEMENTAL QUESTIONS - OID
(continued)

5. "The use of hot keys would make keyboard entry for augmenting, and editing more reasonable."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

6. "The layout of the menu/functions are designed to facilitate quick and efficient use."
_____agree _____disagree

If you disagree, please explain why.

_____

_____

SUMMARY QUESTIONNAIRE:

1. Do you view ASOS as a help or hindrance in performing the weather observations and reporting functions associated with your job? Explain.

2. Do you feel that the ASOS, as presented here, is ready for operational use in an ATCT? Please list any changes you feel should be made other than noted in your questionnaire.

3. General Comments:

NOTE: Should additional space be required, please use the back of the paper and additional sheets as necessary.

APPENDIX B

EVALUATION RESULTS BY QUESTION

ISSUE

	AGREE	DISAGREE	NO OPINION
1. **OID PHYSICAL CHARACTERISTICS**			
a. SIZE OF OID SATISFACTORY	68	13	1
b. OID KEYBOARD SIZE SATISFACTORY	60	21	1
c. GLARE DOES NOT AFFECT OID READABILITY	57	23	2
d. OID SWIVEL AND TILT REDUCES GLARE	64	15	3

ISSUE

2. OID FUNCTIONS

	AGREE	DISAGREE	NO OPINION
a. ASOS PASSWORD NOT REQUIRED	74	7	1
b. OID ALARM SOUNDS LIKE OTHER ALARMS IN TOWER CAB	22	58	2
c. ALARM DISABLED MESSAGE IS NECESSARY	68	10	4
d. WEATHER DATA PRESENTED IN ACCEPTABLE FORMAT	68	14	0

ISSUE	AGREE	DISAGREE	NO OPINION
2. OID FUNCTIONS (CON'T)			
e. TOWER VISIBILITY STEPS REASONABLE	52	27	3
f. STEPS TO VIEW ARCHIVED DATA REASONABLE	46	19	17
g. ERROR RECOVERY STEPS REASONABLE	47	9	26
h. SAVE DATA STEPS FOR MISHAP	N/A	N/A	N/A

ISSUE

3. CVD PHYSICAL CHARACTERISTICS	AGREE	DISAGREE	NO OPINION
a. CVD WINDOW SIZE SATISFACTORY	38	42	2
b. OVERALL CVD SIZE SATISFACTORY	35	45	2
c. GLARE ON CVD AFFECTS READABILITY (SURFACE MOUNT)	69	13	0
d. GLARE ON CVD AFFECTS READABILITY (FLUSH MOUNT)	41	3	3

ISSUE	AGREE	DISAGREE	NO OPINION
3. CVD PHYSICAL CHARACTERISTICS (CON'T)			
e. NIGHT READABILITY SATISFACTORY (FLUSH MOUNT)	14	29	3
f. NIGHT READABILITY SATISFACTORY (SURFACE MOUNT)	44	33	5
g. SIZE OF ALPHANUMERICS SATISFACTORY	66	14	2
h. ADJUSTMENT OF SURFACE MOUNT CVD SATISFACTORY	49	28	5

ISSUE

3. CVD PHYSICAL CHARACTERISTICS (CON'T)	AGREE	DISAGREE	NO OPINION
i. SURFACE MOUNT CVD EASILY STAYS IN ADJUSTED POSITION	41	33	8
j. CVD RESET BUTTON FREQUENTLY USED	15	55	12
k. RESET, CONTRAST AND BRIGHTNESS CONTROL KNOB LOCATIONS SATISFACTORY	57	11	14

ISSUE

4. CVD DISPLAY

	AGREE	DISAGREE	NO OPINION
a. WEATHER PARAMETER PRESENTATION SATISFACTORY	60	18	4
b. CVD WEATHER PARAMETERS ARE ALL THAT ARE REQUIRED TO PROVIDE TO PILOTS	56	21	5
c. WIND DIRECTION AND VELOCITY, AND ALTIMETER ONLY SHOULD BE HIGHLIGHTED	48	31	3

ISSUE

4. CVD DISPLAY (CON'T)

	AGREE	DISAGREE	NO OPINION
d. CVD BRIGHTNESS AND CONTRAST SATISFACTORY	40	40	2
e. CVD BACKGROUND COLOR DISPLAY SUFFICIENT FOR TOWER CAB	40	38	4

ISSUE

	AGREE	DISAGREE	NO OPINION
5. LAWRS - TOWER CAB SUPPLEMENTAL QUESTIONS - OID			
a. ENTERING REMARKS ON OID REASONABLE	6	4	1
b. STEPS TO ENTER PRESENT WEATHER REASONABLE	6	4	1
c. STEPS TO AUGMENT PRESENT WEATHER REASONABLE	6	4	1
d. STEPS TO GENERATE URGENT SPECIAL REASONABLE	6	4	1

ISSUE

	AGREE	DISAGREE	NO OPINION
5. LAWRS - TOWER CAB SUPPLEMENTAL QUESTIONS - OID (CON'T)			
e. OID 'HOT KEY' DESIRABLE	10	1	0
f. MENU/FUNCTION LAYOUT FACILITATE EFFICIENT USE	8	2	1

ISSUE

	AGREE	DISAGREE	NO OPINION
6. OBSERVER NOTIFICATION DEVICE (OND)			
a. OND PROVIDES EXCELLENT VISUAL SIGNAL	8	3	0
b. OND NOT A DISTRACTION DUE TO BRIGHTNESS	6	5	0
c. OND BRIGHTNESS IS SATISFACTORY	8	3	0
d. OND IS A NECESSARY OPTION	7	4	0

ISSUE	AGREE	DISAGREE	NO OPINION
7. CONTROLLER VIDEO DISPLAY (CVD) - TRACON			
a. CVD EASILY READABLE IN TRACON	7	43	2
b. CVD BACKGROUND DISPLAY APPROPRIATE FOR TRACON	6	42	4
c. CVD ADJUSTABILITY AND BRIGHTNESS SUFFICIENT	16	33	3
d. CVD HIGHLIGHTED MESSAGES READABLE	30	18	4

ISSUE

8. SUMMARY QUESTIONNAIRE

	AGREE	DISAGREE	NO OPINION
a. ASOS IS A HELP IN PERFORMING WEATHER OBSERVATIONS	26	46	10
b. ASOS IS READY FOR OPERATIONAL USE	11	61	10

APPENDIX C

EVALUATION RESULTS BY FACILITY

ISSUE # 1a - SIZE OF OID IS SATISFACTORY			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	7	2	
Johnson County	6	0	
Lincoln Municipal	9	5	
Rosecrans Memorial	5	0	
Tulsa Int'l	22	3	
Wiley Post	10	0	
Will Rogers	9	3	1
Totals	68	13	1

ISSUE # 1b - OID KEYBOARD SIZE IS SATISFACTORY			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	6	3	
Johnson County	6	0	
Lincoln Municipal	14	0	
Rosecrans Memorial	4	1	
Tulsa Int'l	16	9	
Wiley Post	6	3	1
Will Rogers	8	5	
Totals	60	21	1

ISSUE # 2a - ASOS PASSWORD NOT REQUIRED FOR ATCS			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	8	1	
Johnson County	6	0	
Lincoln Municipal	10	4	
Rosecrans Memorial	5	0	
Tulsa Int'l	23	2	
Wiley Post	10	0	
Will Rogers	12	0	1
Totals	74	7	1

ISSUE # 2b - OID-ALARM SOUNDS LIKE OTHER ALARMS			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	1	7	1
Johnson County	0	5	1
Lincoln Municipal	6	8	
Rosecrans Memorial	1	4	
Tulsa Int'l	8	17	
Wiley Post	2	8	
Will Rogers	4	9	
Totals	22	58	2

ISSUE # 2c - ALARM DISABLED MESSAGE IS NECESSARY			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	7	2	
Johnson County	4	1	1
Lincoln Municipal	14	0	
Rosecrans Memorial	5	0	
Tulsa Int'l	21	3	1
Wiley Post	7	2	1
Will Rogers	10	2	1
Totals	68	10	4

ISSUE # 2d - WEATHER DATA IN ACCEPTABLE FORMAT			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	9	0	
Johnson County	6	0	
Lincoln Municipal	10	4	
Rosecrans Memorial	5	0	
Tulsa Int'l	17	8	
Wiley Post	10	0	
Will Rogers	11	2	
Totals	68	14	

ISSUE # 2e - # STEPS TO INPUT TOWER VISIBILITY SAT			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	9	0	
Johnson County	2	3	1
Lincoln Municipal	13	1	
Rosecrans Memorial	5	0	
Tulsa Int'l	15	9	1
Wiley Post	6	3	1
Will Rogers	2	11	
Totals	52	27	3

ISSUE # 2f - # STEPS TO VIEW ARCHIVED DATA SAT			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	5	4	
Johnson County	5	1	
Lincoln Municipal	8	2	4
Rosecrans Memorial	5	0	
Tulsa Int'l	14	3	8
Wiley Post	6	2	2
Will Rogers	3	7	3
Totals	46	19	17

ISSUE # 2g - # STEPS TO RECOVER FROM AN ERROR SAT			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	8	0	1
Johnson County	3	1	2
Lincoln Municipal	7	1	6
Rosecrans Memorial	5	0	
Tulsa Int'l	13	1	11
Wiley Post	6	1	3
Will Rogers	5	5	3
Totals	47	9	26

ISSUE # 3a - CVD WINDOW SIZE SATISFACTORY			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	3	6	
Johnson County	4	2	
Lincoln Municipal	6	8	
Rosecrans Memorial	4	1	
Tulsa Int'l	11	14	
Wiley Post	7	3	
Will Rogers	3	8	2
Totals	38	42	2

ISSUE # 3b - OVERALL CVD SIZE SATISFACTORY			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	3	6	
Johnson County	4	2	
Lincoln Municipal	3	11	
Rosecrans Memorial	4	1	
Tulsa Int'l	11	14	
Wiley Post	7	3	
Will Rogers	3	8	2
Totals	35	45	2

ISSUE # 3c - CVD SURFACE MOUNT GLARE AFFECTS READABILITY			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	9	0	
Johnson County	4	2	
Lincoln Municipal	12	2	
Rosecrans Memorial	3	2	
Tulsa Int'l	23	2	
Wiley Post	7	3	
Will Rogers	11	2	
Totals	69	13	

ISSUE # 3d - CVD FLUSH MOUNT GLARE AFFECTS READABILITY			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	9	0	
Johnson County	N/A	N/A	
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	N/A	N/A	
Tulsa Int'l	23	2	
Wiley Post	N/A	N/A	
Will Rogers	9	1	3
Totals	41	3	3

ISSUE # 3e - CVD FLUSH MOUNT NIGHT READABILITY SAT			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	5	3	1
Johnson County	N/A	N/A	
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	N/A	N/A	
Tulsa Int'l	9	16	
Wiley Post	N/A	N/A	
Will Rogers	0	10	3
Totals	14	29	4

ISSUE # 3f - CVD SURFACE MOUNT NIGHT READABILITY SAT			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	5	3	1
Johnson County	3	3	
Lincoln Municipal	5	6	3
Rosecrans Memorial	5	0	
Tulsa Int'l	13	12	
Wiley Post	9	1	
Will Rogers	4	8	1
Totals	44	33	5

ISSUE # 3g - CVD ALPHANUMERIC SIZE SATISFACTORY			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	7	2	
Johnson County	5	1	
Lincoln Municipal	10	3	1
Rosecrans Memorial	5	0	
Tulsa Int'l	21	4	
Wiley Post	9	1	
Will Rogers	9	3	1
Totals	66	14	2

ISSUE # 3h - CVD SURFACE MOUNT ADJUSTMENT SAT			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	6	3	
Johnson County	5	1	
Lincoln Municipal	2	9	3
Rosecrans Memorial	5	0	
Tulsa Int'l	18	7	
Wiley Post	8	1	1
Will Rogers	5	7	1
Totals	49	28	5

ISSUE # 3i - CVD SURFACE MOUNT STAYS IN ADJUSTED POSITION			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	6	3	
Johnson County	6	0	
Lincoln Municipal	4	7	3
Rosecrans Memorial	5	0	
Tulsa Int'l	9	15	1
Wiley Post	8	1	1
Will Rogers	3	7	3
Totals	41	33	8

ISSUE # 3j - CVD RESET BUTTON FREQUENTLY USED			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	1	8	
Johnson County	0	4	2
Lincoln Municipal	0	9	5
Rosecrans Memorial	1	4	
Tulsa Int'l	7	16	2
Wiley Post	3	7	
Will Rogers	3	7	3
Totals	15	55	12

ISSUE 3k - RESET, CONTRAST, BRIGHTNESS KNOB LOCATION SAT.			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	6	2	1
Johnson County	2	1	3
Lincoln Municipal	7	3	4
Rosecrans Memorial	4	1	0
Tulsa Int'l	23	0	2
Wiley Post	10	0	0
Will Rogers	5	4	4
Totals	57	11	14

ISSUE # 4a - CVD WEATHER PARAMETER PRESENTATION SAT			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	6	3	
Johnson County	2	4	
Lincoln Municipal	11	3	
Rosecrans Memorial	5	0	
Tulsa Int'l	19	5	1
Wiley Post	10	0	
Will Rogers	7	3	3
Totals	60	18	4

ISSUE # 4b - CVD WEATHER PARAMETERS ARE ALL REQ. FOR PILOT			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	5	4	
Johnson County	1	4	1
Lincoln Municipal	8	6	
Rosecrans Memorial	5	0	
Tulsa Int'l	22	2	1
Wiley Post	8	2	
Will Rogers	7	3	3
Totals	56	21	5

ISSUE # 4c - WINDS, ALTIMETER SHOULD BE HIGHLIGHTED			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	6	3	
Johnson County	4	2	
Lincoln Municipal	5	9	
Rosecrans Memorial	5	0	
Tulsa Int'l	16	9	
Wiley Post	7	3	
Will Rogers	5	5	3
Totals	48	31	3

ISSUE # 4d - CVD BRIGHTNESS AND CONTRAST ARE SATISFACTORY			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	7	2	
Johnson County	2	4	
Lincoln Municipal	5	9	
Rosecrans Memorial	5	0	
Tulsa Int'l	11	14	
Wiley Post	7	3	
Will Rogers	3	8	2
Totals	40	40	2

ISSUE # 4e - CVD BACKGROUND COLOR SUFFICIENT FOR TOWER			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	4	5	
Johnson County	3	3	
Lincoln Municipal	7	7	
Rosecrans Memorial	5	0	
Tulsa Int'l	10	15	
Wiley Post	7	3	
Will Rogers	4	5	4
Totals	40	38	4

ISSUE # 5a - ENTERING REMARKS ON OID REASONABLE (LAWRS)			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	2	3	1
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	4	1	
Tulsa Int'l	N/A	N/A	
Wiley Post	N/A	N/A	
Will Rogers	N/A	N/A	
Totals	6	4	1

ISSUE # 5b - STEPS TO EDIT PRESENT WX REASONABLE (LAWRS)			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	2	3	1
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	4	1	
Tulsa Int'l	N/A	N/A	
Wiley Post	N/A	N/A	
Will Rogers	N/A	N/A	
Totals	6	4	1

ISSUE # 5c STEPS TO AUGMENT PRESENT WX REASONABLE (LAWRS)			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	2	3	1
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	4	1	
Tulsa Int'l	N/A	N/A	
Wiley Post	N/A	N/A	
Will Rogers	N/A	N/A	
Totals	6	4	1

ISSUE # 5d - STEPS TO GENERATE URGENT SPECIAL REASONABLE			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	2	3	1
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	4	1	
Tulsa Int'l	N/A	N/A	
Wiley Post	N/A	N/A	
Will Rogers	N/A	N/A	
Totals	6	4	1

ISSUE # 5e - OID 'HOT KEY' DESIRABLE (LAWRS)			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	6	0	
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	4	1	
Tulsa Int'l	N/A	N/A	
Wiley Post	N/A	N/A	
Will Rogers	N/A	N/A	
Totals	10	1	

ISSUE # 5f MENU/FUNCTION LAYOUT FACILITATE EFFICIENT USE			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	4	1	1
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	4	1	
Tulsa Int'l	N/A	N/A	
Wiley Post	N/A	N/A	
Will Rogers	N/A	N/A	
Totals	8	2	1

ISSUE # 6a - OND PROVIDES EXCELLENT VISUAL SIGNAL			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	4	2	
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	4	1	
Tulsa Int'l	N/A	N/A	
Wiley Post	N/A	N/A	
Will Rogers	N/A	N/A	
Totals	8	3	

ISSUE # 6b - OND NOT A DISTRACTION DUE TO BRIGHTNESS			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	2	4	
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	4	1	
Tulsa Int'l	N/A	N/A	
Wiley Post	N/A	N/A	
Will Rogers	N/A	N/A	
Totals	6	5	

ISSUE # 6c - OND BRIGHTNESS IS SATISFACTORY			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	3	3	
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	5	0	
Tulsa Int'l	N/A	N/A	
Wiley Post	N/A	N/A	
Will Rogers	N/A	N/A	
Totals	8	3	

ISSUE # 6d - OND IS A NECESSARY OPTION			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	3	3	
Lincoln Municipal	N/A	N/A	
Rosecrans Memorial	4	1	
Tulsa Int'l	N/A	N/A	
Wiley Post	N/A	N/A	
Will Rogers	N/A	N/A	
Totals	7	4	

ISSUE # 7a - CVD EASILY READABLE IN TRACON			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	N/A	N/A	
Lincoln Municipal	2	12	
Rosecrans Memorial	N/A	N/A	
Tulsa Int'l	5	19	1
Wiley Post	N/A	N/A	
Will Rogers	0	12	1
Totals	7	43	2

ISSUE # 7b CVD BACKGROUND DISPLAY APPROPRIATE FOR TRACON			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	N/A	N/A	
Lincoln Municipal	3	10	1
Rosecrans Memorial	N/A	N/A	
Tulsa Int'l	3	21	1
Wiley Post	N/A	N/A	
Will Rogers	0	11	2
Totals	6	42	4

ISSUE # 7c - CVD ADJUSTABILITY AND BRIGHTNESS SUFFICIENT			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	N/A	N/A	
Lincoln Municipal	6	8	
Rosecrans Memorial	N/A	N/A	
Tulsa Int'l	8	16	1
Wiley Post	N/A	N/A	
Will Rogers	2	9	2
Totals	16	33	3

ISSUE # 7d - CVD HIGHLIGHTED MESSAGES READABLE			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	N/A	N/A	
Johnson County	N/A	N/A	
Lincoln Municipal	8	6	
Rosecrans Memorial	N/A	N/A	
Tulsa Int'l	18	6	1
Wiley Post	N/A	N/A	
Will Rogers	4	6	3
Totals	30	18	4

ISSUE # 8a - ASOS IS A HELP IN PERFORMING WEATHER OBS.			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	7	0	2
Johnson County	4	1	1
Lincoln Municipal	0	10	4
Rosecrans Memorial	4	1	
Tulsa Int'l	4	18	3
Wiley Post	6	4	
Will Rogers	1	12	
Totals	26	46	10

ISSUE # 8b - ASOS IS READY FOR OPERATIONAL USE			
Tower Facility	Agree	Disagree	No Opinion
Grand Island	5	0	4
Johnson County	0	5	1
Lincoln Municipal	0	13	1
Rosecrans Memorial	1	4	
Tulsa Int'l	1	20	4
Wiley Post	3	7	
Will Rogers	1	12	
Totals	11	61	10

APPENDIX D

LIST OF AD HOC MEETING ATTENDEES

Enclosure (2) to Summary Memorandum for ASOS Ad Hoc TIM, dated January 15, 1993

NAME	ORGANIZATION	PHONE
Steve Hodges	ANW-400	(202) 267-7849
Steve Imbembo	ANW-140	(202) 267-8668
George McConnell Jr.	ANW-140	(202) 267-8671
Bill Roe	ANW-140/NYMA	(202) 488-4118
C. J. Cox	ANW-140/MMC	(202) 646-4785
Phil Barbagallo	ACW-200	(609) 484-5307
Mike Greco	FAA ASOS APMT, ACW-200A	(609) 484-6817
Chris Malitsky	ACW-200B	(609) 484-6250
Rick Fortner	ACW-200B/TPI	(609) 484-6594
James Miller	ACW-200B/Raytheon	(609) 641-5544
Ed Nuzman	ACW-200B/Raytheon	(609) 641-5544
Bruce Ware	ACW-200B/TPI	(609) 484-6594
Gloria Yastrop	ACW-200B/Raytheon	(609) 641-5544
Bill Fish	ATM-110	(202) 267-9365
Jon Preston	ACE-510	(816) 426-3400
Jeff Most	LNK ATCT	(402) 474-3011
Andy Taylor	OKC ATCT	(405) 685-3761
Humberto Garcia	ASW-511D	(817) 624-5517
Ed Castagna	ATR-130	(202) 267-9445
Jerry Owens	AAI-SMI	(410) 785-1217
Dick Reynolds	NOAA-SPO2	(301) 427-2165
Vickie Nadolski	NOAA-SPO22	(301) 427-2175
Ralph Beard	ATP-124	(202) 267-9337
Patrick M. Gode	ATM-120.7	(202) 267-7040
Hal Bogin	NWS OSD14	(301) 713-1781
Dave Pace	ASE-100/SEIC	(202) 646-5962
Mike Porter	ASE-100	(202) 287-8619

APPENDIX E

SHORT-TERM REQUIREMENTS SCHEDULE

OID/CVD Short-Term Requirements Schedule

1.	FAA Define Short-term Requirements, ANW-140	2/19/93
2.	Review Requirements, FAA/NOAA/NWS/AAI 45-day Clearance Record	4/19/93
3.	Requirements Meeting	5/11/93
4.	FAA Requirements => NOAA	5/19/93
5.	NOAA Send Requirements => AAI	6/18/93
6.	AAI ECP	7/16/93
7.	NOAA ECP => FAA	7/16/93
8.	ECP Approval	8/20/93
9.	AAI Contract Mod Turn-On	8/20/93
10.	AAI Test	12/93 - 2/94
11.	AAI Deliver Prototype Hardware	12/93 - 2/94
12.	FAA Technical Center Test	3/94
13.	Site Tests	4/94
14.	Test Meeting	5/94